Fort Hall Reservation Stream Enhancement

Annual Report
2000 - 2001

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Habitat Restoration/Enhancement Fort Hall Reservation
FY 2001 Annual Report

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ABSTRACT

Habitat enhancement, protection and monitoring were the focus of the Resident Fisheries Program during 2001. Enhancement and protection included sloping, fencing and planting willows at sites on Diggie Creek, Clear Creek and Spring Creek. In addition, many previously constructed instream structures (rock barbs and wing dams) were repaired throughout the Fort Hall Indian Reservation (Reservation).

In 2001, exclosure fences were erected on Diggie Creek (250 m barbed wire; 70 m jack), Wood Creek (500 m jack), Clear Creek (20 m jack), Ross Fork Creek (200 m jack), West Fork Creek (200 m jack)) and the Portneuf River (1 km barbed wire; 100 m jack). Jack and rail exclosure fences that had deteriorated over the past ten years were repaired at numerous areas throughout the Reservation.

Physical sampling during 2001 included sediment and depth surveys (SADMS) in Big Jimmy Creek and Diggie Creek. SADMS, used to track changes in channel morphology and specifically track movements of silt through Bottoms stream systems were completed for eight and nine strata in the Big Jimmy and Diggie Creek, respectively. Baseline SADM data was collected in Diggie Creek to monitor the effects of bank sloping and revegetation on channel morphology and sediment levels through time. Water temperature was monitored (hourly) in Spring Creek, Clear Creek, Ross Fork Creek and Big Jimmy Creek.

Biotic sampling included invertebrate sampling in the 200 and 300 series of Clear Creek. Fish population densities and biomass were sampled in Clear Creek 200 and 300 series. Sampling protocols were identical to methods used in past years. Numbers of fish in Clear Creek 300 series remained similar to 2000 while numbers of fish in Clear Creek 200 series dropped to near pre project levels. Salmonid fry densities were monitored near Broncho Bridge and were significantly higher than 2000. A mark-recapture study was initiated in spring 2001 to estimate numbers of spawning adults using the Head End of Spring Creek

Mean catch rate by anglers on Bottoms streams increased from 0.55 in 2000 to 0.77 fish per hour in 2001. Numbers of fish ≥ 18" caught by anglers decreased from 0.41 in 2000 to 0.19 in 2001.

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INTRODUCTION

The primary goal of the Resident Fisheries Program (RFP) is to restore, enhance, and protect Fort Hall Indian Reservation (Reservation) streams so they can support native fish populations at historic levels. Streams on the Reservation have been negatively affected (i.e. loss of riparian vegetation, downcutting, and lateral scouring of streambanks) by a variety of sources, including, livestock grazing; American Falls Reservoir construction and operations; and the 1976 Teton Dam collapse. Cattle, bison, and horses have been present on the Reservation since the early 1800's. Damage to streambanks from years of unrestricted grazing continues to be a problem on Reservation streams. In addition, rapid flooding and drafting of American Falls Reservoir in conjunction with seasonal freeze-thaw cycles is a cause of streambank failures on lowland Reservation streams. Negative impacts from streambank failures include, widened channels; a reduction in riparian vegetation and instream cover; increased summer water temperatures; and deposition of fines on critical spawning gravel.

In 1992, the RFP, by cost-sharing Bonneville Power Administration and Bureau of Indian Affairs projects, began large-scale, low-tech, habitat restoration projects on the Reservation. Restoration was directed at stabilizing eroding banks, deepening and narrowing stream channels, and restoring diversity to the spring-stream environment with instream structures. Restoration efforts were originally focused on Clear Creek, a heavily impacted Reservation stream. The RFP has also directed efforts toward other Reservation streams, including, Spring; Diggie and Big Jimmy creeks. The primary focus of restoration has changed over the course of the project, in particular, less reliance on in-stream structures and more reliance on exclosure fencing and natural healing processes. Work done in 2001 involved physical and biotic assessments of project locations; development and implementation of fencing projects; repair of streambanks through sloping, seeding, willow planting, rock barbs, and exclosure fencing. As in years 1994-2000 skilled-labor crews of the Salmon Corps were cost-shared into the habitat restoration effort. The assessment of past habitat restoration successes and failures is imperative to the efficacy of any habitat improvement project. Changes in project focus are the result of information collected on changes in stream channel morphology and trends in fish population densities at restoration sites. Silt And Depth Measurement (SADM's) surveys, developed by the

RFP for low-gradient spring creeks, continued to be used to assess changes in channel characteristics in treatment and control areas of streams on the Reservation.

DESCRIPTION OF PROJECT AREA

The Fort Hall Indian Reservation, located in southeastern Idaho, is drained by more than twenty streams (Figure 1). Of particular importance, are streams in the Fort Hall Bottoms, a large wetland adjacent to the Snake River near its entrance into American Falls Reservoir. These streams are all spring fed, low gradient, and relatively short in length.

Of the four primary Bottoms streams, Spring Creek is the largest (12.75 m^3/s and approximately 15 km in length)(Figure 2) and Clear Creek is the second largest (4.5 m^3/s and approximately 11 km in length)(Figure 3). Bottoms streams provide critical wintering, spawning, and nursery habitats for adfluvial and resident salmonids (Taki and Arthaud 1993). Wintering and nesting waterfowl, shorebirds, and raptors also heavily use the streams, lateral springs and surrounding marshlands. Endangered bald eagles and trumpeter swans winter, nest and fish on the Bottoms.

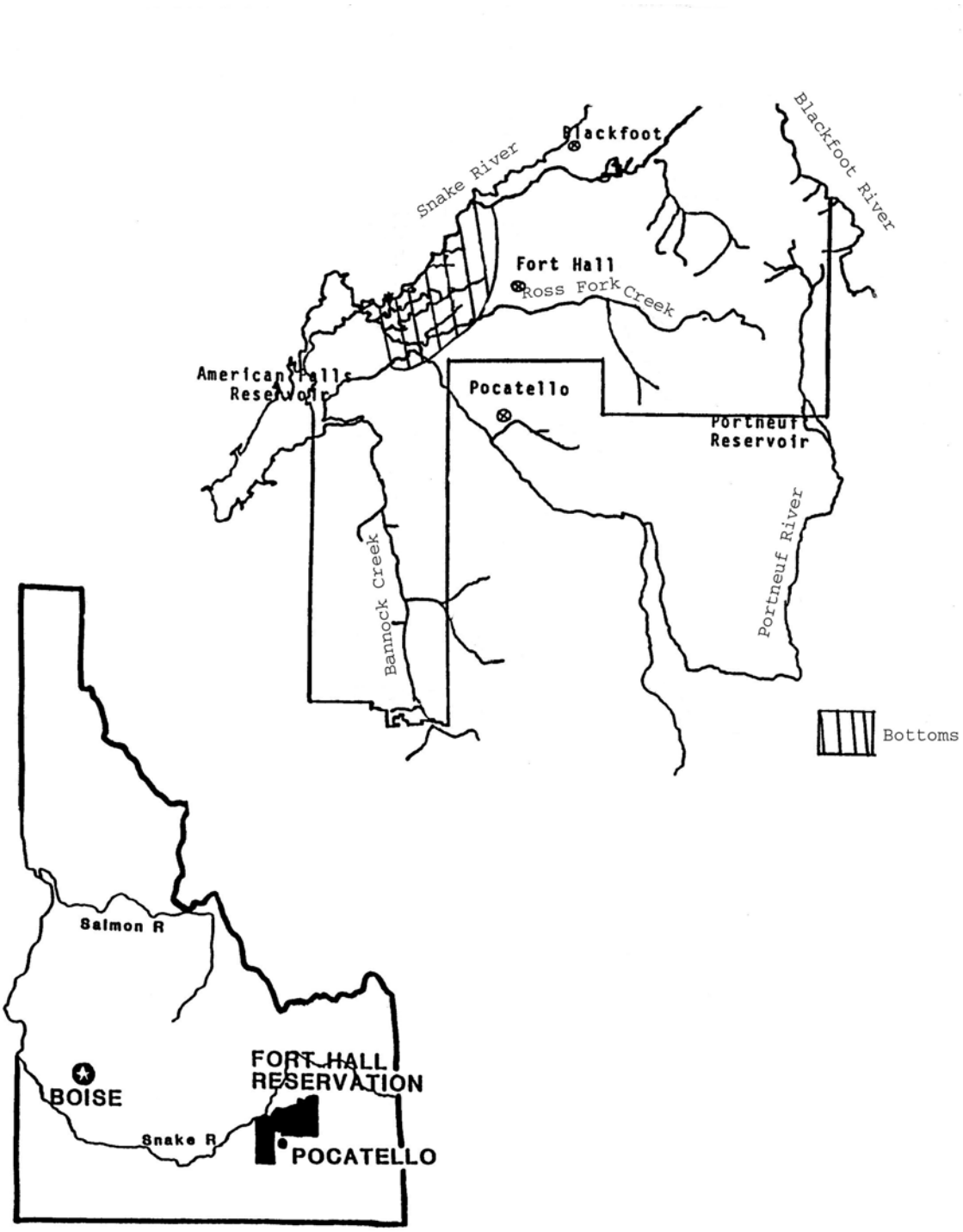


Figure 1. - Location of Fort Hall Indian Reservation.

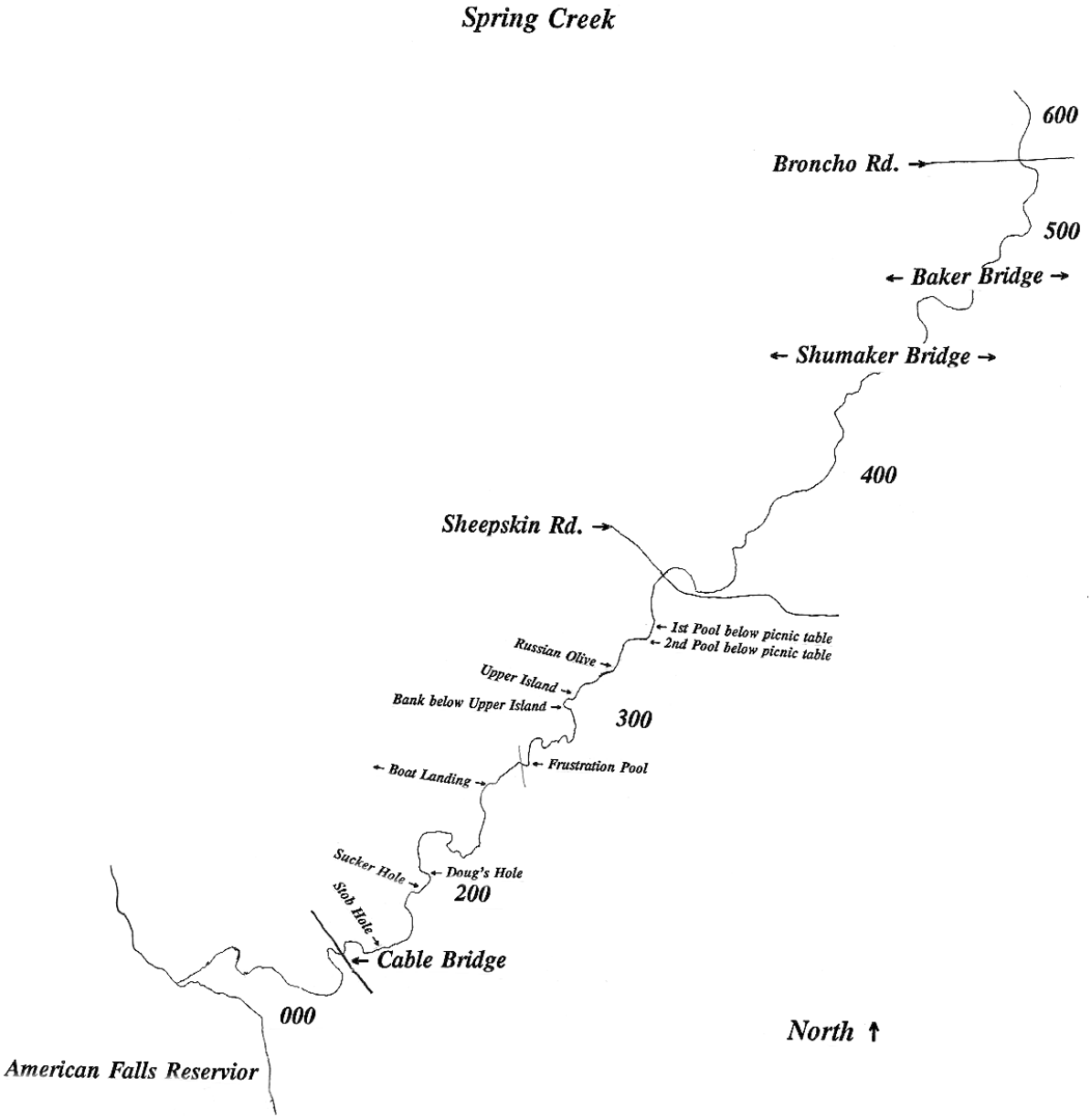


Figure 2. - Map of Spring Creek showing project locations.

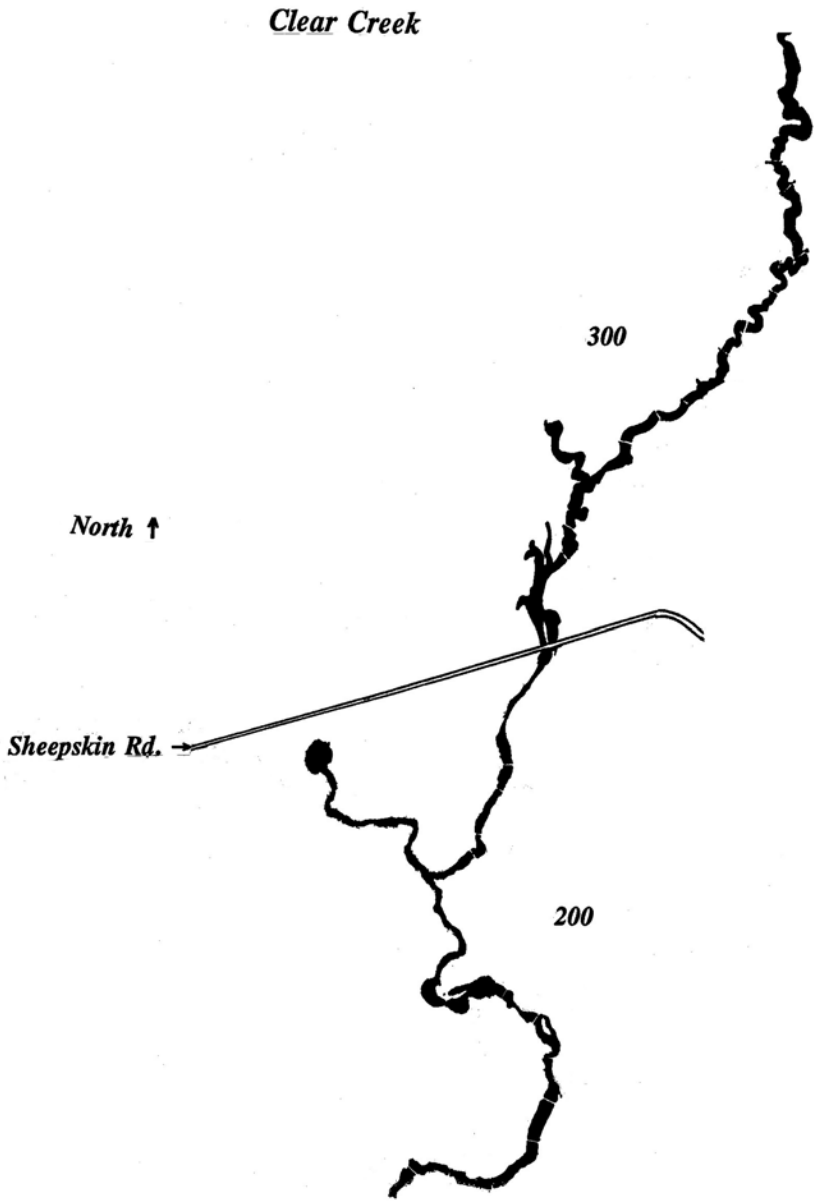


Figure 3. - Map of Clear Creek showing 200 and 300 series.

METHODS AND MATERIALS

Habitat Enhancement/Protection

Sloping and Revegetation

Salmonid and interdependent species habitats were directly enhanced using a suite of streambank restoration techniques. The process used to restore downcut/bare stream banks is as follows; 1) The toe/waterline of areas of downcut streambank is first lined with evergreen trees or other suitable revetments. 2) Streambanks are then sloped to an angle less than 45 degrees using hand tools. 3) If necessary, bare slopes are seeded with native grasses and given an initial watering. 4) Willow poles approximately two meters in length and one inch in diameter are planted along the length of sloped bank to a depth of at least 1.5 meters. 5) Jack and rail fencing is erected along the restored streambank. 6) If necessary, rock barbs are placed in the stream to divert flow away from erosive areas. Willow planting methods have changed several times since project inception. Originally, 0.5 inch willow shoots were cut and planted along the toe of banks to a depth of approximately 6-10". Later, better survival was gained planting short willow poles at least 1" in diameter, but to a similar depth. Increased energy reserves in thicker plants had helped short term survival but long term survival was inhibited by dewatering and flooding. In 2001, a water jet stinger was purchased to aid in rapidly planting willow poles deep into the substrate, higher up the streambank. These new techniques appear to be increasing survival of riparian plantings.

Fencing

Two types of fences were used to build or repair exclosures during 2001. Four strand barbed wire was used when areas to be fenced were long (> 500 m) and relatively straight. Four rail jack fence was constructed when short sections of fence were needed or the line that fence would follow was sinuous and on uneven terrain. In past years three rail jack fence was constructed using 16 foot rails. Four rail fence using 13 foot rails has had greater longevity and requires less maintenance.

Physical Sampling

SADM surveys

Levels of silt, water depth and stream width (SADMS) were measured in the 200 series of Big Jimmy Creek. Between eight and ten equidistant transects (ten individual measurements each transect) were measured along each strata. Each individual measurement included a water depth and silt depth. SADM data were collected from eight strata of Big Jimmy Creek 200 series and nine strata of Diggie Creek east series. Data in Big Jimmy Creek were analyzed using repeated measures ANOVA, means were discriminated using Scheffe's post hoc test.

Chemical Measurements

Since 1995 five water quality parameters have been monitored (dissolved oxygen, conductivity, total dissolved solids, pH, and temperature) on the Reservation. In 2001, equipment failures precluded collection of water quality data. However, trend data from 1997-2000 were analyzed to elucidate changes in water quality for the five constituents at all Reservation sites.

Water Temperature

Stowaway temperature recorders were placed in shaded well mixed areas of water and set to record water temperature hourly from May to October of 2001. Temperature data was analyzed and is presented as maximum, average and minimum daily water temperature.

Biotic Sampling

Fish Populations

Fish populations were monitored in the 200 and 300 series of Clear Creek (Figure 3) with a tote barge electrofisher. A one-pass estimator of population size was used to save time, money, and reduce stress to fish (Arthaud and Taki 1994). Data collected was analyzed in terms of fish species composition, biomass and density per $100m^2$ of stream.

Fry Counts

On three occasions, snorkeling equipment was used to count numbers of young-of-the-year (fry) fish along the edge of four hundred and sixty meters of streambank at head end Spring Creek (Malvestuto 1983). Over the past ten years juvenile rearing habitat has been enhanced in this area using evergreen tree revetments. Fry counts provide a simple method of estimating the efficacy of revetments and trends in fry abundance through time.

Mark-Recapture Study

Spawning populations of hybrids (rainbow trout x cutthroat trout), cutthroat trout *(Oncorhynchus clarki spp.)* and rainbow trout (*Oncorhynchus mykiss spp.)* were monitored during early spring of 2001 at the head end of Spring Creek using mark-recapture techniques. On six occasions (January 12, January 15, January 16, January 24, February 1, February 22) spawning fish were herded downstream into a Fyke net, lengths measured, identified (sex and species) and tagged with a Floy tag. Results were analyzed using the standard Jolly Seber model for open populations (Jolly; 1965). In addition, Snorkel surveys were completed on three occasions to count redds and supplement mark-recapture data on adult spawners.

Invertebrates

Invertebrate samples were collected from the 200 and 300 series of Clear Creek. Samples are currently being processed. Hess samples were taken from three areas of gravel within each strata. Samples will be compared to previous years samples using appropriate metrics, including, richness, diversity and EPT ratios

RESULTS AND DISCUSSION

Habitat Enhancement/Protection

Sloping and Revegetation

Table 1 shows survival counts for willow shoots, pole cuttings and wattles planted at habitat enhancement sites on Spring Creek from 1994 to 2001. Percent survival of over-wintering

willows ranged from a low of 0.00% to a high of 71.67%. Over-winter survival of willow plantings appears to be variable and site specific. New planting techniques initiated in 1999, specifically, increased depth of planting and increased length of willow poles planted appears to be increasing survival of willows. Three new restoration sites were completed in 2001. In 2001, one 50 meter section of streambank on Diggie Creek was sloped and planted with willows. In addition, 604 willows were planted at previously sloped banks and areas already hydraulically stable but in need of additional vegetation. In 2001, Diggie Creek was delineated using SADMS to monitor changes in channel morphology after implementation of restoration/protection projects In addition, photo points recorded for each sloping will be used to monitor bank stability over time. Figure 4 shows a photo point at Frustration Hole (Spring Creek), pre sloping, two years post sloping and six years post slopng. Figure 5 shows the positive effects of an exclosure on riparian vegetation at the head end of Spring Creek. In addition, willow survival (Table 1) will be monitored yearly and repairs will be made to revetments and rock barbs when necessary.

Fencing

Analysis of past data collected from exclosure projects shows the ability of stream ecosystems to heal naturally given time and removal of causative agents (e.g. grazing and reservoir influences) (Moser 1998). In 2001, exclosure fences were erected on Diggie Creek (250 m barbed wire; 20 m jack), Wood Creek (500 m jack), Clear Creek (20 m jack), Ross Fork Creek (200 m jack), West Fork Creek (200 m jack) and the Portneuf River (approximately 1 km barbed wire; 100 m jack). Jack and rail exclosure fences that had deteriorated over the past ten years were repaired or replaced) at numerous areas throughout the Fort Hall Indian Reservation.

Figure 4. - Photo point, Frustration Hole, Spring Creek, 1995, 1997 and 2001.

Figure 5. - Pre-exclosure Spring Creek head end (1990) and post-exclosure with willow planting (2001).

Table 1. - Location, numbers, and survival of willow shoots, poles and wattles planted from 1994 to 2001. Counts were made October, 2001.

Pre-1999 Plantings	Plantings	Alive	Dead	Missing	Survival
1st Pool 300	270	10	30	230	3.70%
2nd Pool 300	1158	19	51	1088	1.64%
Russian Olive 300	102	3	21	78	2.94%
Shoemaker	1163	0	86	1077	0.00%
Turnoff to Sucker Weir	180	32	148	0	17.78%
Bend on Spring Creek	1,608	2	308	1298	0.12%
Upper Island	305	16	46	243	5.25%
Above Upper Island	1215	0	292	923	0.00%
Cut Bank Above Upper Island	175	0	2	173	0.00%
Frustration Hole	183	0	22	161	0.00%
Boat Landing	575	17	300	258	2.96%
Sucker Hole	220	27	26	167	12.27%
Dougs Slopings	887	0	105	782	0.00%

1999 Plantings

Dougs Slopings	164	36	8	120	21.95%

2000 Plantings

Diggie East Bank Upper	39	24	4	11	61.54%
Diggie East Bank Lower	105	43	50	12	40.95%
Diggie West Bank	60	43	17	0	71.67%

2001 Plantings

Clear Creek Culvert	38	7	13	18	18.42%
Spring Creek Broncho	249	141	73	35	56.63%
Diggie East Fork	317	160	138	19	50.47%

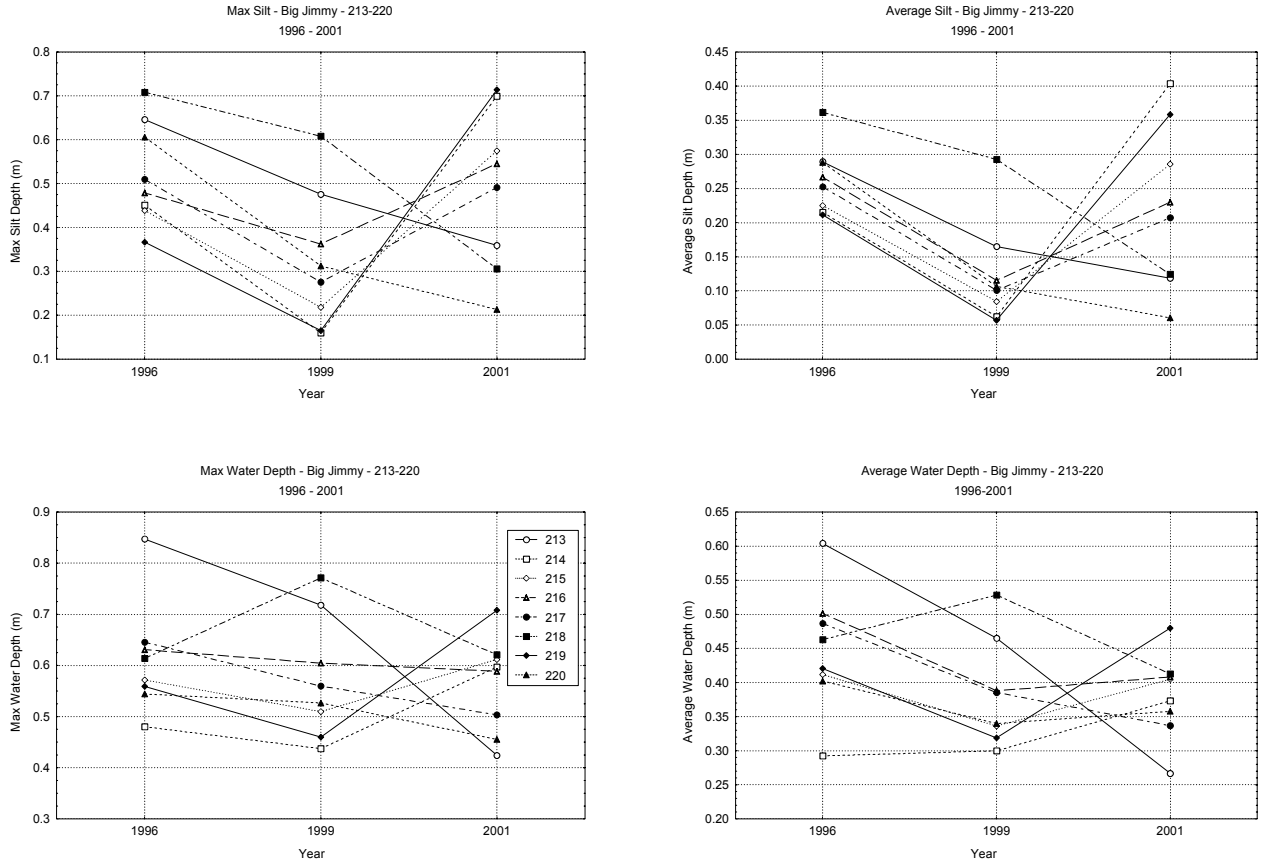


Figure 6. - Plot of means of silt and water depth in Big Jimmy Creek strata 213-220, 1996, 1999 and 2001.

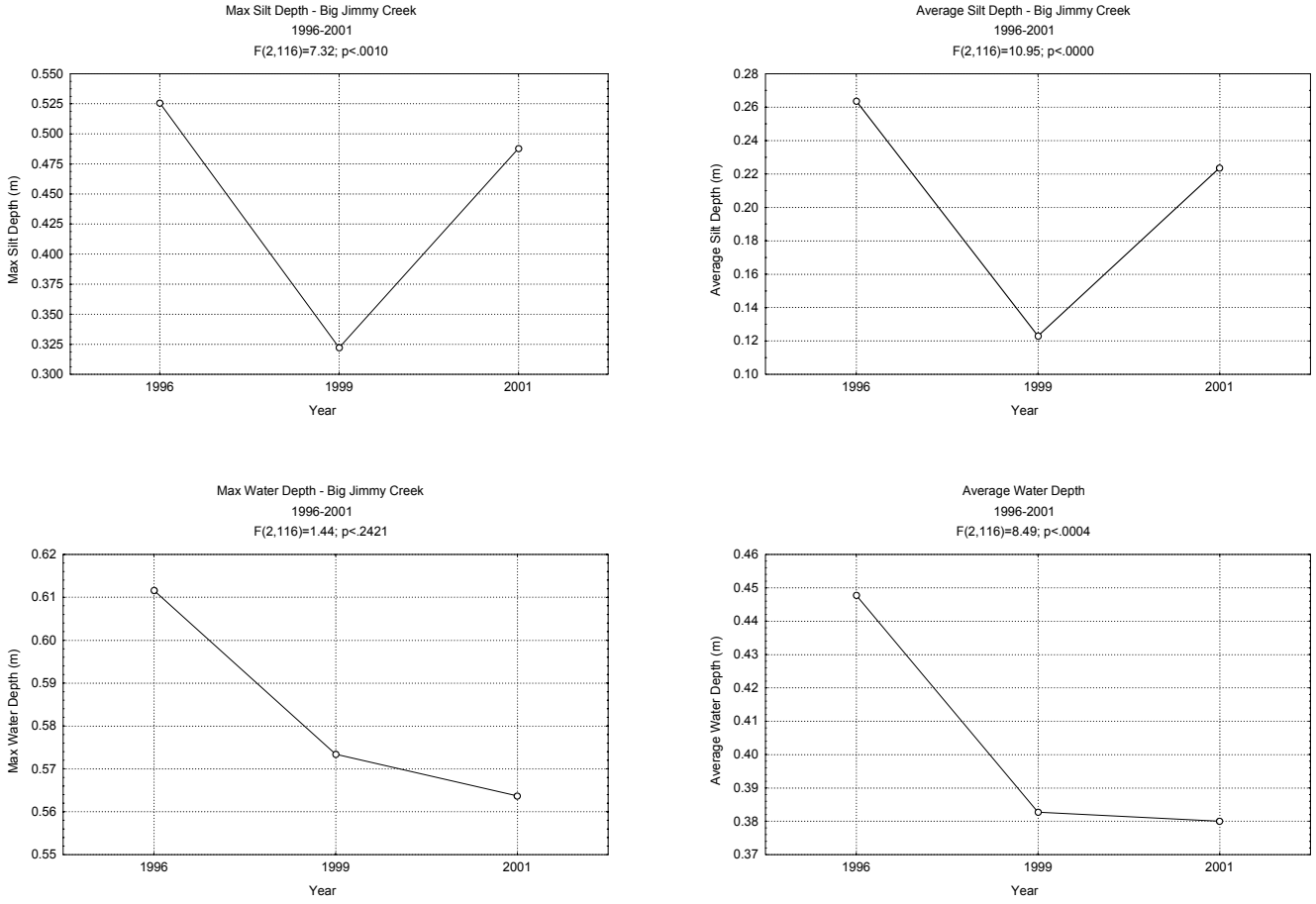


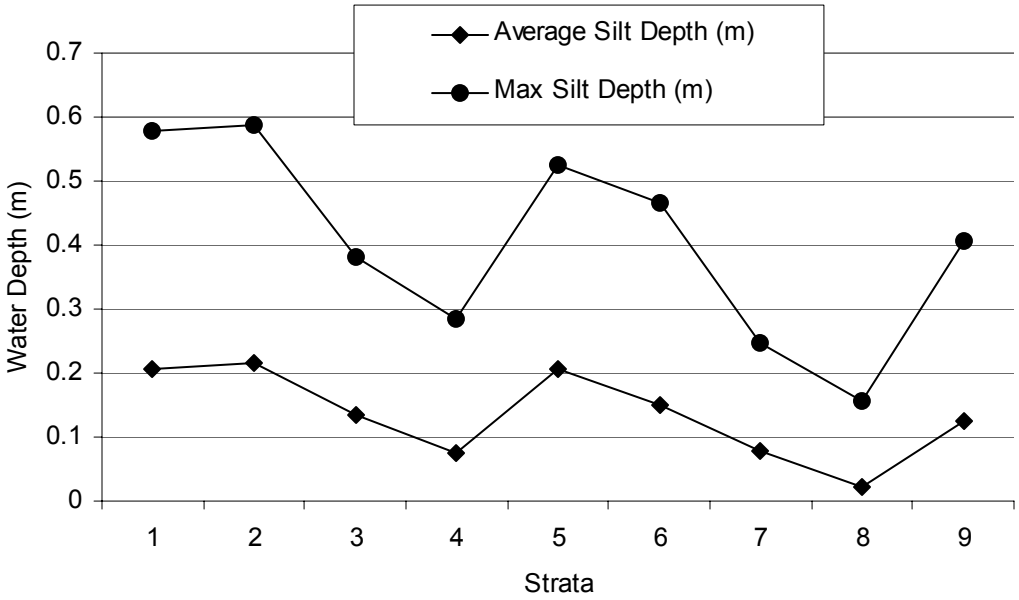
Figure 7 - Plot of combined means (ANOVA) of silt and water depth for all strata in Big Jimmy Creek, 1996, 1999 and 2001.

Physical Sampling

SADM surveys

SADM data was collected in the 200 series of Big Jimmy Creek. Figure 6 shows means of maximum and average silt depth and maximum and average water depth for each strata (213-220) in 1996, 1999 and 2001. Most strata showed a decrease in maximum and average sediment from 1996 to 1999, primarily due to flood flushing flows in 1997. Between 1999 and 2001 sediment levels increased back to near pre flood levels. Three strata associated with a culvert, a weir and a road crossing continued to move sediment to downstream strata (220, 218 and 213, respectively). Repeated measures ANOVA (Figure 7) was used to compare overall gains and losses of sediment in the reach between years 1996, 1999 and 2000. Overall, both maximum silt depth and average silt depth decreased significantly after the flood of 1997 ($p< 0.05$, Figure 7) and returned to near pre flood levels in 2001. Maximum and average water depth both decreased from 1996 to 2001 (average water depth significant at $p<0.5$). In past years, water depth (cover) in Big Jimmy Creek was created by growth of aquatic macrophytes at stream margins increasing center channel flow and flushing out small areas of sediment . The flood of 1997 decreased sediment throughout the stream, reducing the streams ability create small areas of depth in the thalweg. Other forms of fish cover in Big Jimmy are rare. Historically, Big Jimmy may have been much deeper and narrower with undercut banks. Currently, fish populations are sparse and the bulk of use is limited to winter and spring spawning.

SADM data was collected and nine strata of East Diggie Creek were delineated in 2001. Diggie Creek has been designated as a priority area for future stream restoration, protection and enhancement projects. Figure 8 shows plots of average water depth and average silt depth in strata one to nine on East Diggie Creek. Information on water depth silt depth, stream width and flow velocity will be used to monitor changes in stream channel morphology after implementation of restoration projects.



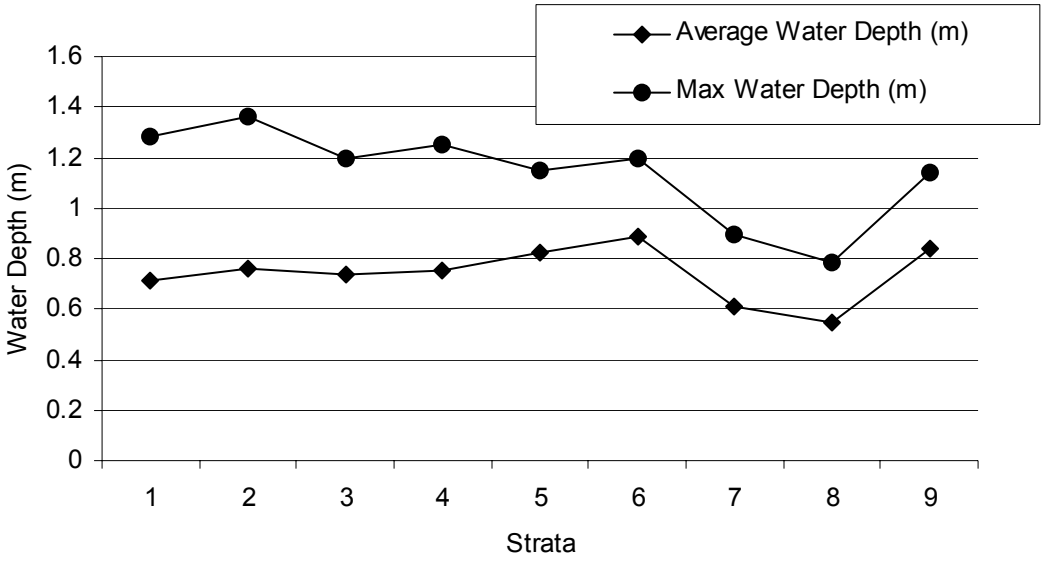
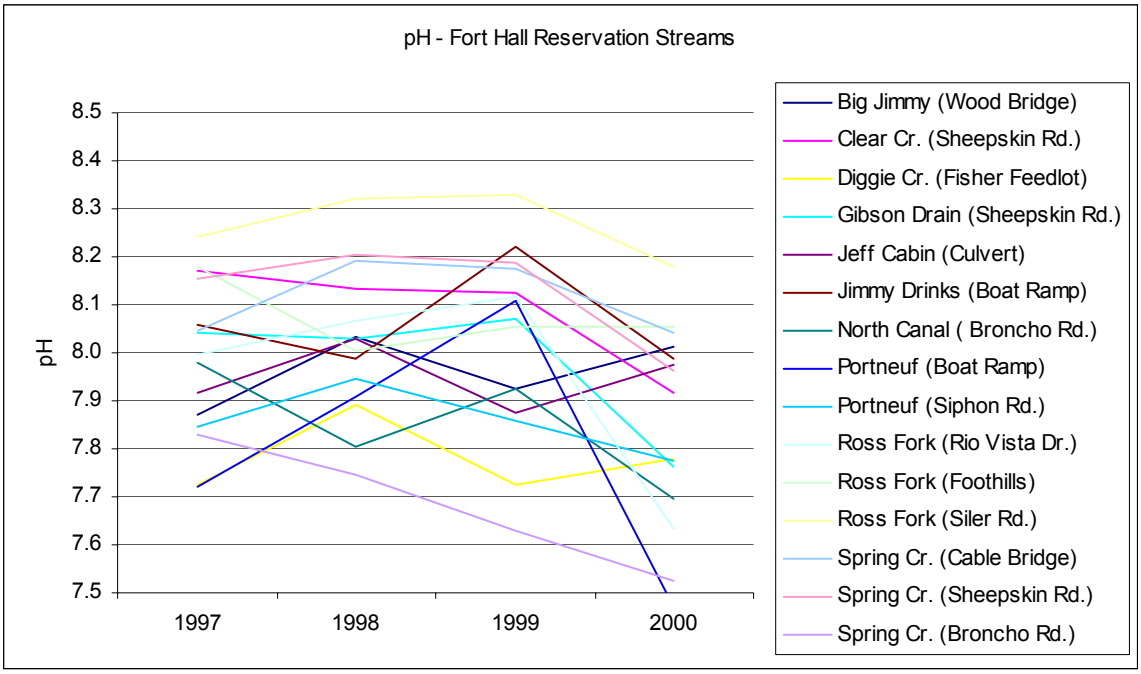


Figure 8. - Average and max silt and water depth, Diggie Creek, 2001.



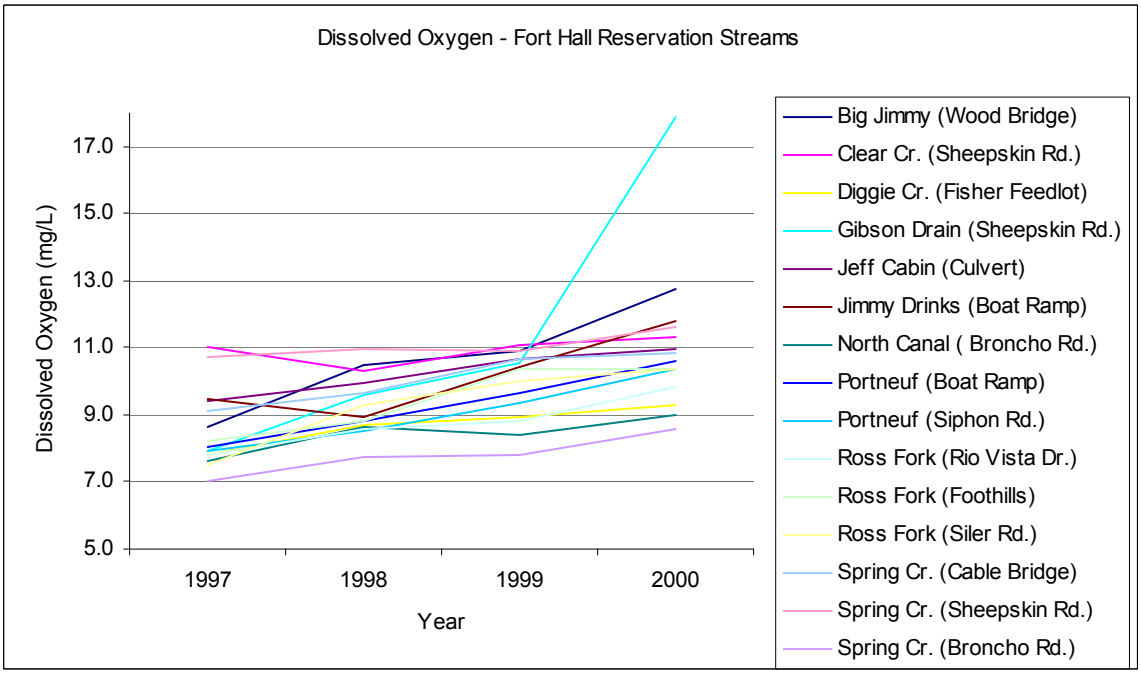
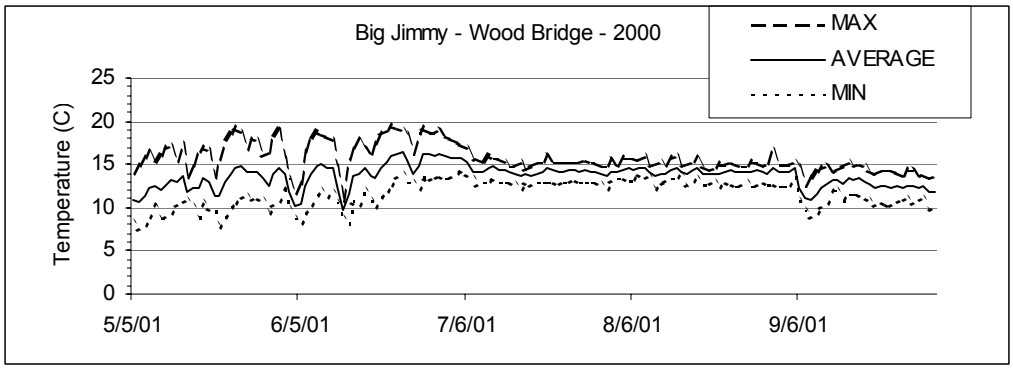
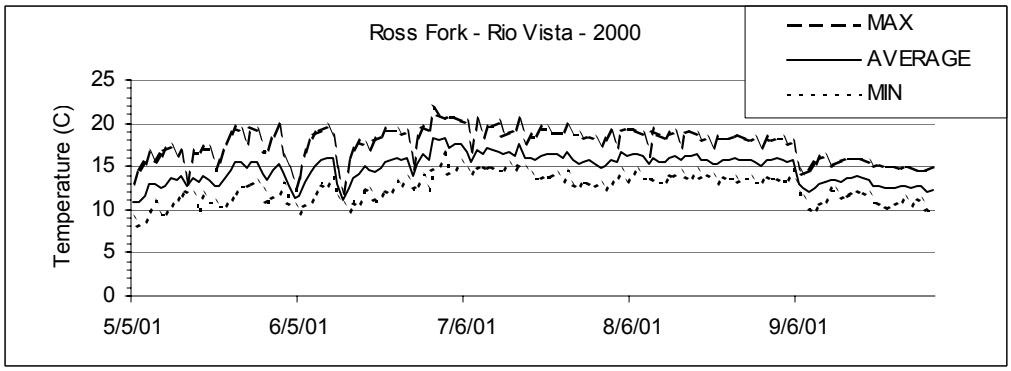
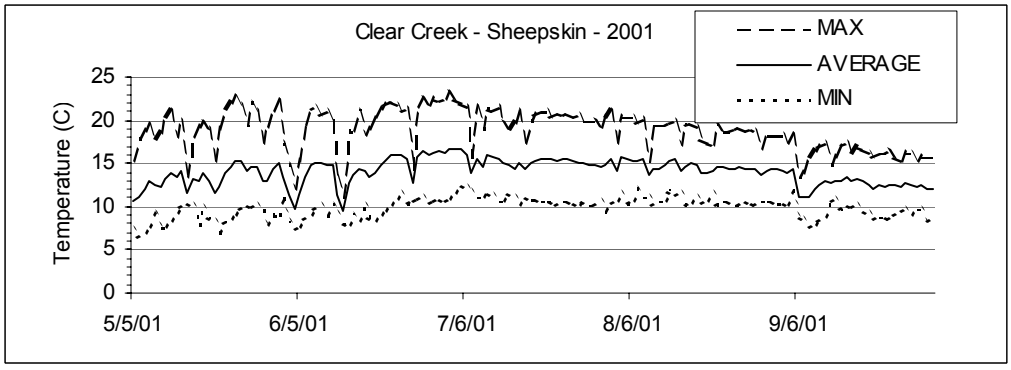


Figure 9. - Average pH and dissolved oxygen levels recorded at various Fort Hall Reservation locations from 1997 to 2001.







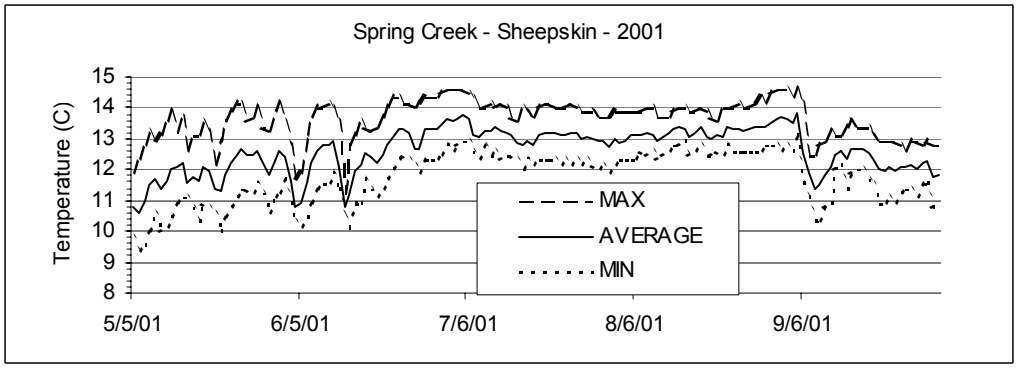


Figure 10. - Maximum, average, and minimum temperatures from Big Jimmy, Clear Creek, and Ross Fork Creek. 5/05/00 to 10/1/00.

Chemical Measurements

Figure 9 shows average pH and dissolved oxygen (mg/L) for 15 sites for the years 1997-2000. Plots were also created for conductivity and total dissolved solids but not displayed. Individual and average measurements of pH, dissolved oxygen, conductivity and total dissolved solids were within state and federal water quality standards. Supersaturated dissolved oxygen levels in Gibson Drain indicate there might be a problem with dissolved oxygen sinks at night. High total dissolved solids measurements in Gibson Drain during winter indicate slightly saline conditions.

Water Temperature

Stowaway temperature recorders were placed in Clear Creek (300 series), Big Jimmy Creek (Wood Bridge), Ross Fork (Rio Vista) and Spring Creek (Sheepskin Bridge). Recorders were set to measure water temperature hourly from May to October of 2001. Temperature data was analyzed and is presented as maximum, average and minimum daily water temperature (Figure 10). Clear and Ross Fork creeks both exceeded 20 C on several occasions during 2001. The Ross Fork site is heavily channelized and is made up of irrigation return flow during the summer months. Clear Creek is relatively wide, shallow and slow moving.

Biotic Sampling

Fish Populations

Fall Clear Creek fish sampling data from 1988 to fall 2001 was summarized in Figure 11 and shows abundance and biomass trends of wild salmonids and stocked finespot cutthroat trout. After habitat work began in spring 1992, wild trout populations and their biomass increased for both Section 200 and 300 (Figure 11). In 2001, densities and biomass of wild trout in the 200 series of Clear Creek were lower than in 2000. Densities and biomass in the 300 series were at low levels in 2000 and 2001. Densities and biomass of fish in Clear Creek have returned to pre project levels. Improvements in habitat, specifically, water depth (lower water temperatures) and clean spawning gravel have likely been lost over time. Continued protection from grazing

influences and natural changes in channel morphology through time will be the primary factors which restore ecosystem health to Clear Creek.

Table 2. - Dates of adult snorkel counts at the Head End of Spring Creek, 2001.

Date	# Adults Counted	# Redds Counted
Dec. 21	82	40
Jan. 08	380	100+
Feb. 13	410	100+

Table 3. - Mark-recapture study, 150 meters of stream, Head End, Spring Creek, 2001.

Date	Method	# Fish Caught	# Fish Tagged/Recaps/Pop Estimate
Jan. 3	Hook and Line	2	2
Jan. 4	Hook and Line	1	1
Jan. 5	Hook and Line	2	2
Jan. 12	Fyke Net	0	0
Jan. 15	Fyke Net	0	0
Jan. 16	Fyke Net	10	10
Jan. 24	Fyke Net	29	27/2/**62**
Feb. 1	Fyke Net	25	23/2/**1,144**
Feb. 22	Fyke Net	40	35/5

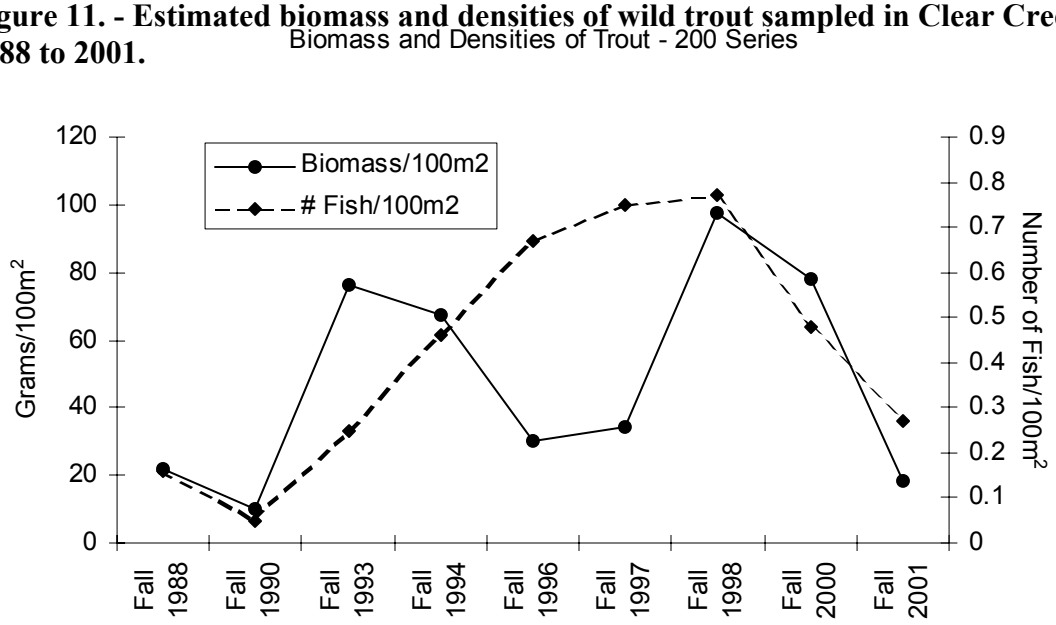
Fry Counts

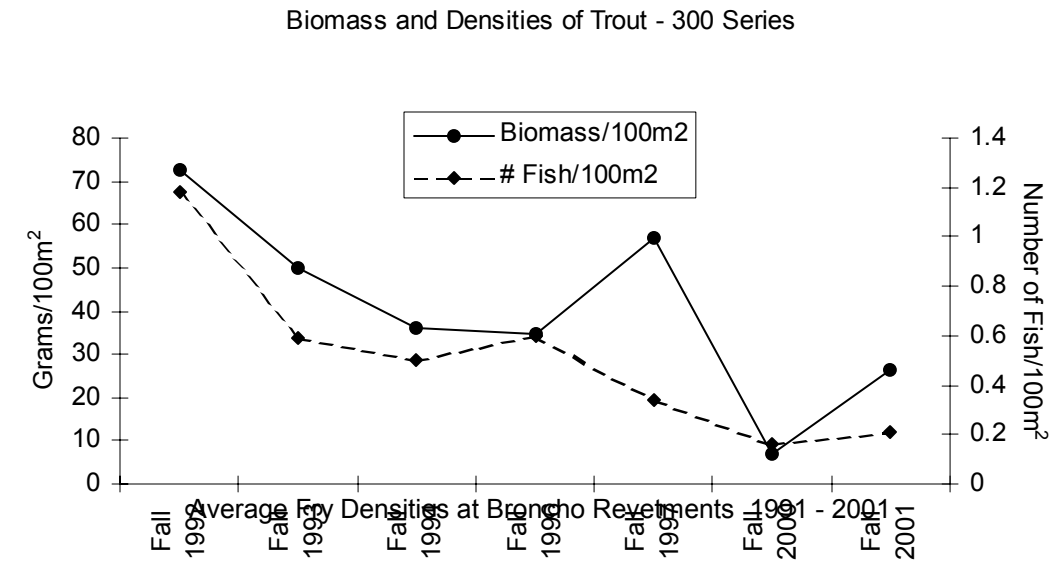
Tree revetments in Spring Creek near Broncho Bridge were snorkeled on three occasions in 2001. Average fry counts in 2001 were higher than previous years at 1.24 fry/m^2. Newly placed revetments (1999) that had not shed needles provided increased areas for fry to hide and made snorkel counts difficult. Replacement of evergreen revetments may have been the reason low numbers of fry were counted in 1999 and 2000. In 2001 all of the needles had fallen off revetments allowing more accurate counts but still providing cover. Revetments appear to be providing increased juvenile cover for fry and aggrading sediment to the lateral margins of Spring Creek. Figures 12 and 13 show number of fry counted during 2001 and average number of fry counted from 1991 to 2001.

Mark-Recapture Study

The Mark-Recapture study did not produce precise population estimates because of problems with unequal effort, low numbers of recaptures, and likely immigration of new spawning individuals. However, results indicate that high numbers of fish use the Head End of Spring Creek to spawn. Using snorkel counts and results derived from the Jolly-Seber model (Tables 2 and 3) we estimate the numbers of fish (during spawning season) at the Head End of Spring Creek above Broncho Bridge (0.6 km) to be between 1,400 and 2,400 individuals. Many of these individuals may be migrating from areas downstream which lack spawning gravel. The high numbers of fish, redds and evidence of redd superimposition indicate the importance of the Head End for recruitment of new individuals in Spring Creek. Future restoration in this area should focus on placement/replacement of evergreen revetments and continued protection/restoration of riparian areas.

Figure 11. - Estimated biomass and densities of wild trout sampled in Clear Creek from 1988 to 2001.





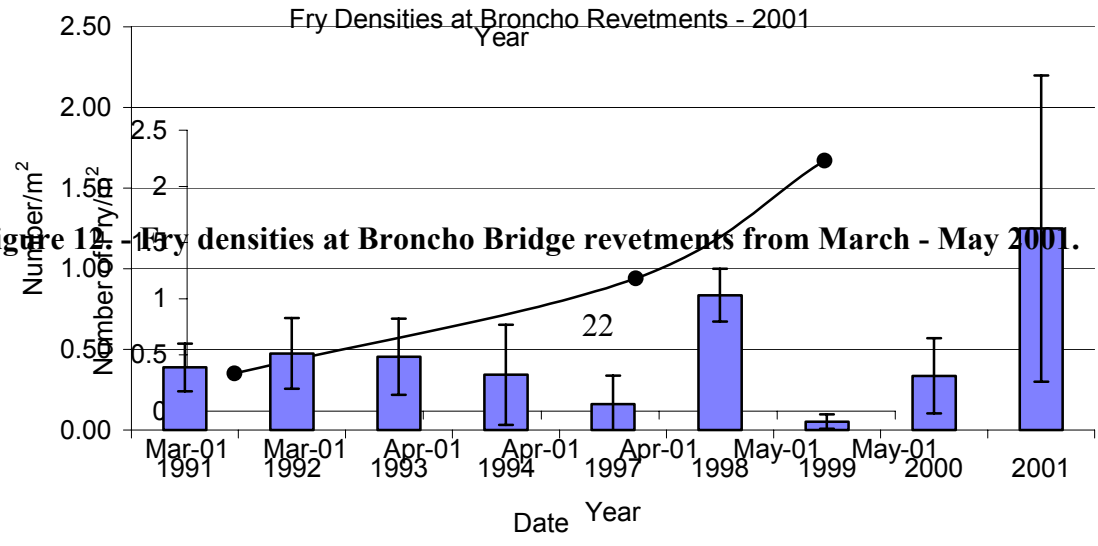


Figure 12. - Fry densities at Broncho Bridge revetments from March - May 2001.

Figure 13. - Average fry densities at Broncho Bridge revetments from 1991 to 2001.

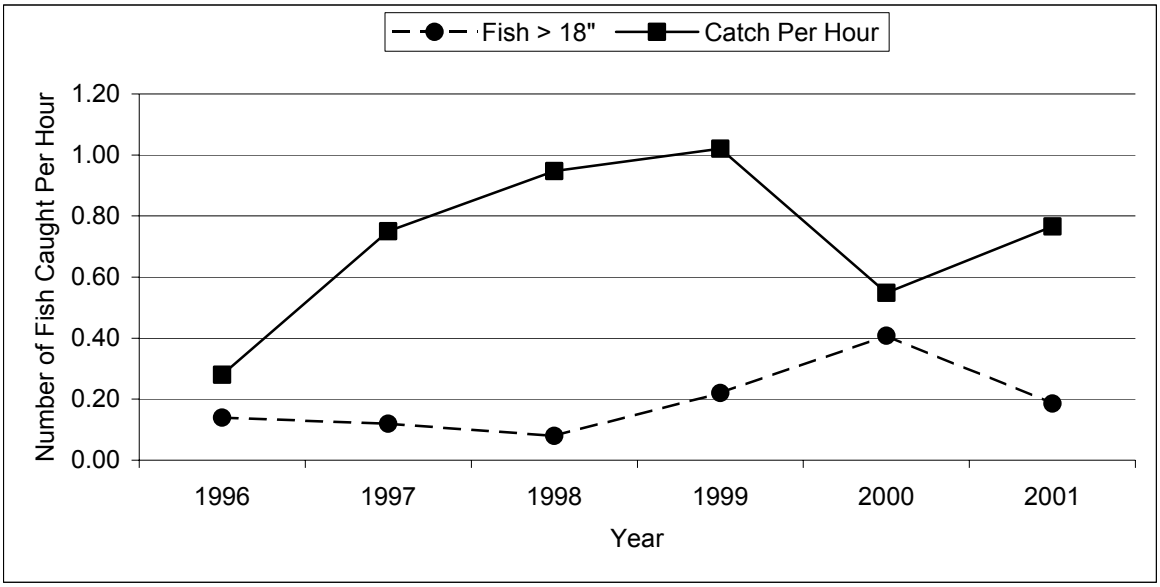


Figure 14. - Catch per hour and fish caught greater than or equal to 18" on Spring Creek for the years 1996-2001

Creel Survey

Permit and Tribal Member anglers on Spring Creek were surveyed at random times throughout the summer. Figure 14 shows catch per hour data from 1996 to 2001. Season catch rates were higher than 2000 at 0.77 fish/hr and number of trophy trout caught was lower than 2000. Higher catch rates and smaller sizes may be an artifact of increased stocking rates of juvenile and eyed egg finespot cutthroat trout over the last three years.

Fish Stocking

In June 2001, approximately 530,000 eyed finespot cutthroat trout eggs were outplanted to Spring Creek, Big Jimmy Creek, Diggie Creek and Jimmy Drinks Creek. Eggs were incubated within instream incubators on the stream surface or buried in clean gravel. In addition, during June 20,000 (4-6") finespot cutthroat trout were planted in Spring Creek and Diggie Creek. Fish were obtained from Jackson National Fish Hatchery (Jackson, Wyoming).

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